

PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Method of and Apparatus for Withdrawal, Storage and Inventory of Articles in Storage Containers

- We, S.A.M.E.T.O. (SOCIÉTÉ D'APPLICATIONS MÉCANIQUES D'ÉLECTRICITÉ ET DE TOLÉRIE) a limited liability Company organized under French law of 11 bis, Avenue Victor Hugo, Paris 16e, France, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- This invention relates to an automatic storing, withdrawing and the inventory of articles stored in containers occupying within a storeroom places determined by reference to the goods which they contain.
- In spare-part stores for example, there arises the problem, hitherto unsolved, of ensuring a controlled and inventorised storage of articles held in storage containers. The multiplicity of the articles stored and the handling operations being a source of wastage of time, it appeared expedient to conceive a method of simplifying the storing and retrieval operations, by reducing to the greatest possible extent the manual operations and thus avoiding the always possible errors of classification.
- The invention also has for object to provide an installation for putting into effect the aforementioned method and making possible the automatic handling, in containers or similar receptacles, of articles which, by reason of signals issued by a control board handled by a single operator, are withdrawn or stored with simultaneous recording of such operation.
- The method according to the present invention is essentially characterised therein, that it consists of indexing the articles to be stored by categories, assigning to each index a storage container, coding each indexed container according to two or three co-ordinates depending of the total number of containers to be stored in a store having one or several bays of a predetermined volume, associating with each index of articles a memory device which records, by the intermediary of an electrical accounting machine capable of receiving and transmitting signals, the incoming and outgoing items typed on a typewriter capable of receiving and transmitting signals, feeding the number of the article concerned in stock to a group of four luminous decadic tubes clearly indicating to the operator the available number of the article concerned and initiating the operation, for the purpose of storing or withdrawing said article, of a handling device which moves, according to the coded co-ordinates assigned to the container holding the article concerned, in a store.
- The installation serving for executing the above-defined method is essentially characterised therein that it comprises a transmitting-receiving typewriter coupled with a computer likewise capable of receiving and transmitting signals which is associated, for each article, with a memory device indicating the entry or withdrawal of the corresponding indexed article, said memory device transmitting its signals to a display system with decadic tubes and/or to the solenoids of typewriter or to the solenoids of the computer and supplying, when the operation of withdrawal (positive stock) or of storage (incompletely filled container) are possible, a pulse which initiates the displacement of a handling device which then removes the desired container for the withdrawal or storing of one or several articles and returns said container thereafter to its initial position within the store.

In order to avoid unnecessary movements of the handling apparatus in the case where the stock of an article is nil, the installation comprises, according to another feature of the invention, a blocking device which, when the container of the article to be withdrawn is empty, blocks the handling device and supplies a visual signal.

According to a further feature of the invention, each memory block assigned to a given article comprises a system of diodes rendering possible the binary coding of the various decimal figures to be recorded, said block comprising sixteen electro-mechanical relays each of which has four reversing contacts to each of which there is connected a diode blocking the reverse current and preventing the series-connection of several circuits.

Other features and advantages of the invention will be apparent from the following description with reference to the accompanying drawings which illustrate schematically and by way of an example only, an installation serving to put into effect the method for storage and inventory of the articles.

In these drawings:—

Fig. 1 is a schematical, perspective view of a three-bay storeroom, each of the bays being served by a handling device, as well as of the control console and the operator;

Fig. 2 is a circuit diagram of an electro-mechanical memory C;

Fig. 3 is a circuit diagram of a display device D; and

Fig. 4 is a circuit diagram of the device transcribing the state of the stock, coupled with the solenoids of a typewriter A; and,

Fig. 5 is a block diagram of the installation.

Referring first to Fig. 5 a printer or typewriter A is connected to a computer B having its own internal mechanical memory. The computer B is connected to a group of electromechanical memories C each of which corresponds to a particular reference code. The electromechanical memories C are all connected to a display device D which is connected to a handling device E and to the typewriter A.

The overall operation of the system is as follows. The operator types a reference code on the typewriter, with the result that the electromechanical memory C which corresponds to that reference code is connected to the display device D which displays the number stored in that memory C. The operator then types out the number of articles to be added to or removed from the stock and depresses the button for addition or subtraction. The computer B then, using its own internal mechanical memory, calculates the new number of article and feeds that number into the electromechanical memory

C. The display device D then actuates the handling device E to bring it to the storage bin containing the articles to which the typed out reference code corresponds.

As already stated, the installation comprises:

a) A typewriter A capable of transmitting and receiving signals, with electrical keyboard;

b) A computer B for adding and subtracting operations, likewise capable of transmitting and receiving signals;

c) A group of electromechanical memories C by means of which all numbers comprised between zero and 9999 can be recorded for each article;

d) A display device D including a group of four illuminated decade counter tubes;

e) A handling device E which is displaced according to the reference of the article typed on the typewriter and which is locked to the computer so as to move only in the case where the operation of withdrawal is possible, that is to say, when the number of articles to be withdrawn is less than or equal to the number registered in the memory unit.

Each of the memory blocks is assigned to a certain article and is constituted by sixteen electromechanical relays fed with direct current of 48 volts. Each of the relays comprises four reversing contacts which are mounted and interlinked on a plate made of an insulating material which serves as a support for a printed circuit corresponding to the wiring shown in Fig. 2. To prevent the current from passing in the other direction and also to avoid the series-connection of several circuits, a blocking diode is connected to each of aforesaid reversing contacts. The relays are grouped to make possible the recording and the reading on four decade-counter tubes, said recording being effected by energizing the coil of one or several relays for each decade.

The functioning the installation as a whole will now be described in more detail.

A. Storage.

On the control console, the operator types on the typewriter the reference of the article to be stocked. This reference is for example formed of two figures making possible to select the memory group corresponding to an abscissa and an ordinate. If the number of articles located in abscissa and ordinates is greater than 9, the reference code will be composed of a greater number of figures. It is equally possible to conceive a three-dimensional reference code, corresponding to spatial co-ordinates.

The actuation of the keys of the typewriter brings about the engagement of an equal number of relays, the contacts of which connect to the general circuit the memory C

corresponding to the reference code typed out.

The operator then types on his typewriter the number of the articles to be put into storage. This numerical value is immediately transmitted to the computer, the solenoids of which are directly connected to the keys of the typewriter.

Thanks to the translating register of the accounting machine, the last figure typed gives the number of units in the computer, the penultimate figure gives the number of tens, etc. Once this has been completed, the operator can actuate an electric step-by-step unit which successively connects the various decades of the mechanical memory within the computer with the decades of the electromechanical memory C. Once it has completed its scanning cycle, the step-by-step unit clears the mechanical memory of the computer by a pulse exerted on the solenoid corresponding to the summing key of said machine. The numerical values transmitted by the typewriter to the computer then pass from the latter into the electromechanical memory C corresponding to the reference code of the article put in storage, the recording into that memory C being effected in the following manner:

When the step-by-step unit has connected the decade element of the mechanical memory of the computer with that of the electromechanical memory, an electric pulse is fed to the circuit thus established. The coder with diodes illustrated in Fig. 2 then brings about the engagement, in function of the figure held in the mechanical memory of the computer, of one or several relays coupled with the decade tubes and with the typewriter.

In this manner, the first four numbers each actuate a relay, namely:

the number 1, the relay M_1 by the circuit 1—1
the number 2, the relay M_2 by the circuit 2—2
the number 3, the relay M_3 by the circuit 3—3
the number 4, the relay M_4 by the circuit 4—4

Each of the numbers 5, 6, 7 and 9 actuates two relays, namely:

the number 5, the relay M_1 by the circuit 5—51—1 and
the relay M_3 by the circuit 5—52—2
the number 6, the relay M_1 by the circuit 6—61—1 and
the relay M_2 by the circuit 6—63—3
the number 7, the relay M_2 by the circuit 7—72—2 and
the relay M_4 by the circuit 7—74—4
the number 9, the relay M_3 by the circuit 9—93—3 and

the relay M_4 by the circuit 9—94—4
Alone the number 8 actuates three relays, namely:

the relay M_2 by the circuit 8—82—2
the relay M_3 by the circuit 8—83—3

the relay M_4 by the circuit 8—84—4.

The number "0" corresponds to the rest position of all relays, whereas for all other values these relays are maintained in transfer position by their self-feed contacts.

B. Lecture of the memory.

By simply typing out the code of the article the quantity in stock of which is to be determined, at all times, the values found for the units, tens, hundreds and thousands by the step-by-step unit can be read off the illuminated decade-counter tubes; it is also possible to type these directly on the typewriter, by which means a daily inventory can be kept and the stock renewed in good time.

The reading off the illuminated decade-counter tubes is effected by the closure of the relays defining the reference code of the article.

The contacts 10 and 1 (Fig. 3) being closed, the circuits corresponding to the different numbers are completed in the following manner for display in clear on the decade-counter tubes or for transmission to the solenoids of the typewriter:

The digit 1: In this case, as already indicated, the relay M_1 is closed and there is formed the circuit 14—34—54—406, the relays defining the reference code of the decade tube.

The digit 2: In this case, the relay M_2 is closed and there is formed the circuit 14, 34, 306, 403, leading to the terminal "2" of the decade tube.

The digit 3: For this digit, the relay M_3 closes, establishing the circuit 14, 34, 54, 204, 401, leading to the terminal "3" of the decade tube.

The digit 4: The relay M_4 closes, establishing for this digit the circuit 14, 34, 54, 104, 201, 303 leading to the terminal "4" of the decade tube.

The digit 5: Two relays close for this digit, namely the relays M_1 and M_3 , establishing the circuit 14, 34, 54, 203, 306, 404 leading to the terminal "5" of the decade tube.

The Digit 6: As in the case of the digit 5, this digit causes two relays to close, namely the relays M_1 and M_3 , which then establish the circuit 14, 34, 54, 204, 402, leading to the terminal "6" of the decade tube.

The digit 7: Two relays are likewise actuated for this digit, namely the relays M_2 and M_4 , establishing the circuit 14, 34, 54, 104, 201, 304 leading to the terminal "7" of the decade tube.

The digit 8: As already stated, three relays are closed for this digit, namely M_2 , M_3 and M_4 , which establish the circuit 14, 34, 54, 104, 202, 302, thus energizing the terminal "8" of the decade tube.

The digit 9: This digit close two relays, namely M_3 and M_4 , whereby the circuit 14, 34, 54, 104, 202, 301 is established, leading to the terminal "9" of the decade tube.

The result is clearly readable on the decade counter tubes T_m , T_{10} , T_1 and T_0 connected to the memory C concerned. However, each of the terminals 1, 0, 5, 2, 6, 3, 7, 4, 8, 9 of the decade counter tubes can also be electrically connected with the solenoids of the typewriter, which can also bring about the automatic typing-out—after closing of the corresponding relay "IMP" Fig. 4—of the value appearing on the corresponding decade tube.

C. Withdrawal of items.

When the operator has typed the reference code of the article to be withdrawn from stock, he has simultaneously selected the electro-mechanical memory C assigned thereto. This causes the number held within that memory C to be displayed immediately on the decade-counter tube and starts up the electric step-by-step unit which relays this number, decade by decade, to the computer; Fig. 2 shows the four contacts S_m , S_{10} , S_1 , S_0 controlling the memory-selection relay for the thousands, hundreds, tens and units.

The operator then composes on the typewriter the number of articles to be withdrawn from storage, the information fed by the typewriter being transmitted to the computer associated therewith which subtracts this number from the number held in stock and records the result in its internal mechanical memory.

The electromechanical memory C is reset to zero at the end of the operation by means of an erasing contact E which cuts the automatic feed of the relays the coils of which then cease to be energized and fall into the open position.

The electric step-by-step unit transmits to the electromechanical memory C, decade by decade, the value of the remainder held in the mechanical memory C. Two possibilities arise. The remainder is positive or zero and the withdrawal is possible or the remainder is negative which means that the number of articles to be withdrawn is greater than the number in stock. The computer then establishes a contact which illuminates a "-" sign to one side of the decade counter tubes, prevents the erasure of the electromechanical memory C and locks the handling device E. The actuation of a "cancellation" key makes possible the erasure of the mechanical memory of the computer B, so that a new operation of withdrawal may be effected.

D. Handling.

As already stated, as soon as the operator has typed the reference code of the article

to be stored or withdrawn from storage, where the text of the name and the reference code in question are clearly typed on the typewriter, the automatic searching and withdrawal cycles of the container bearing the reference selected are initiated immediately.

The cycle is as follows:—

The recording of the reference of the article, while selecting the memory C assigned to said article for inventory purposes, has also selected the contacts defining the co-ordinates of the container within the storage bay. One of these contacts defines the abscisse of the container in relation to the unloading or loading position taken as origin. The second contact defines the ordinate of the container in relation to the ground level taken as origin, i.e. the serial number of the horizontal row in which the container is located.

As soon as the inscription of the designation of the article has begun, the handling device E is displaced horizontally and vertically as a function of its actual co-ordinates and of the co-ordinates of the container holding the category of articles selected.

Three cases are possible:

a) The handling device E has previously replaced a container into the horizontal row wherein the container now to be withdrawn is located. It then will move sideways only until it reaches the point corresponding to the abscissa of the container selected.

b) The handling device E has previously replaced a container the ordinate of which is the same as of the container now to be withdrawn. In this case, it will move in vertical direction only.

c) The handling device E is at any given position. Its handling platform then moves simultaneously along a horizontal and a vertical axis until it reaches the point corresponding to the co-ordinates of the container selected. The handling device then removes the container to the manual position where it can be loaded or unloaded and, once this has been completed, returns the container to its place, whereafter it is ready to execute another operation.

E. Inventory.

The installation according to the invention makes it possible, thanks to its memories C, to effect very rapidly the inventory of the existing stock and to transcribe this inventory to the typewriter article by article, the reading of the memories being carried out reference by reference, where the terminals of the decade-counter tubes are connected by the intermediary of the contacts "IMP" Fig. 4 to the solenoids of the typewriter. There is obtained in this manner an up-to-date inventory of the existing stock within a very short time.

This inventory is effected in the following manner:

The actuation of the "inventory" key starts up an electrical step-by-step unit which connects the memory C of a first article to the decade counter tubes and the solenoids of the typewriter. At this instant, a second step-by-step unit scans, letter by letter, the text corresponding to the name of the first article. This text is formed with the aid of the connections linking each position of the step-by-step unit. This step-by-step unit then scans the electro-mechanical memory C of the articles concerned decade by decade.

The information collected by this scanning of the memory unit is fed to the numerical solenoids of the printer. When the information concerning the articles in stock has been transcribed in the typewriter, the first step-by-step reference unit connects up the memory C of the second article to be inventoried.

These operations succeed each other identically until the last article has been inventoried at which instant there is available on the typewriter a record describing the exact state of the stock in hand.

By feeding the informations contained in this inventory (which may be established in the form of punched tape) to a programming device instructed to prepare orders for the parts concerned when a certain "stock level" has been passed, requisition cards can be made out directly.

The embodiment of the invention as described and illustrated herein was presented by way of a non-limiting example only and diverse modifications thereof are possible without departing from the invention.

Thus, for example, the coding of the containers has been described as effected with reference to two co-ordinates only, for the sake of simplicity. It would of course be possible to effect the coding with reference to three co-ordinates and even by sections, since the storeroom could be divided into sections each having a handling device discharging the containers on to a conveyor belt which would carry them to a handling station located near the operator.

Similarly, the binary coding device has been described with reference to the case of the numeral value 9999. It is evident that in the case where a number of articles greater than this figure the device could be modified and its system of relays extended in other directions.

Instead of using the electromechanical memories of the type herein described, it would be equally possible to incorporate magnetic memory units exploited by electronic means which, for an equal volume of space, would have a much greater storage capacity.

WHAT WE CLAIM IS:—

1. A method for the automatic withdrawal, storage and inventory of articles held in containers occupying in a store positions pre-

determined by the reference to the article which they contain, characterised therein that it consists in indexing by categories the articles to be stored, assigning to each article reference a storage container, coding each container according to two or three co-ordinates in function of the total number of containers to be stored in a storeroom having one or several bays of a predetermined capacity, associating with each article reference a memory unit recording, by the intermediary of a computer capable of receiving and transmitting signals, the incoming and outgoing quantities of said articles typed on a typewriter likewise capable of receiving and transmitting signals, feeding in each case the value of the quantity in stock to a group of four illuminated decade-counter tubes for clearly displaying to the operator the number of available articles and initiating the action, for the purpose of storing or withdrawing said article from storage, of a handling device moving according to the coded co-ordinates assigned to the container holding the article concerned.

2. An installation for carrying out the method according to Claim 1, characterised therein that it comprises a typewriter capable of receiving and transmitting signals linked with an electrical accounting machine likewise capable of transmitting and receiving signals which is associated for each article with a memory device indicating the incoming and outgoing quantities of the corresponding indexed article, said device transmitting its indications to a display system comprising decade-counter tubes and/or to the solenoids of typewriter or to the solenoids of the computer and supplying, when the operation of either withdraw (positive stock) or storage (incompletely filled container) is possible, a pulse initiating the displacement of the handling device which fetches the desired container for effecting the withdrawal or the storage of one or several articles and then returns said container to its initial position within the storeroom.

3. An installation according to Claim 2, characterised therein that it includes a blocking device which, when the container of an article to be withdrawn is empty, blocks the handling device and supplies a visual signal.

4. An installation according to Claim 2 or Claim 3, characterised therein that each memory unit assigned to a given article is associated with a diode system making possible the binary coding of the decimal numbers to be recorded, said memory unit comprising sixteen electro-mechanical relays each provided with four inverting contacts to each of which there is connected a diode blocking the reverse current and preventing the series-connection of several circuits.

5. An installation according to one or more of the Claims 2 to 4, characterised therein

that it comprises a handling device controlled by the memory units and functioning only when the operation of withdrawal recorded by the machine is possible.

hereinbefore described with reference to the accompanying drawings.

- 5 6. A method of and an installation for the automatic withdrawal, storage and inventory of articles in containers occupying predetermined positions in a store substantially as

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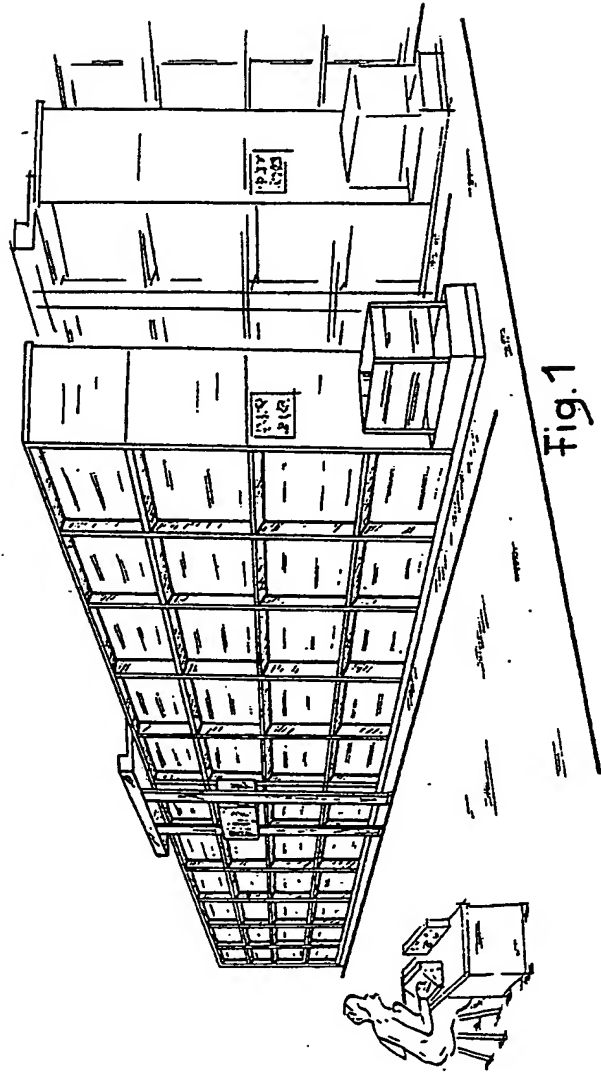
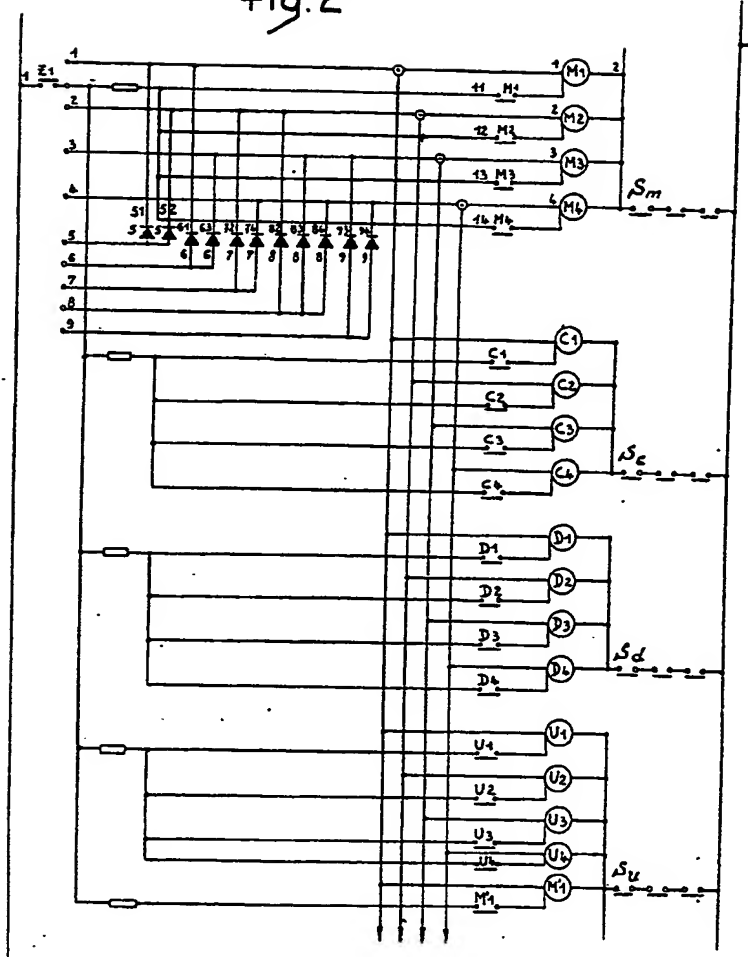


Fig. 2



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 Sheets 1 & 2

Fig. 2

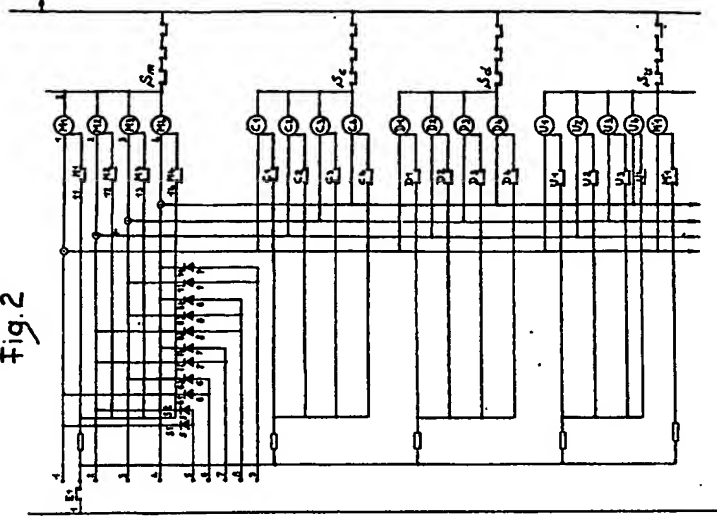
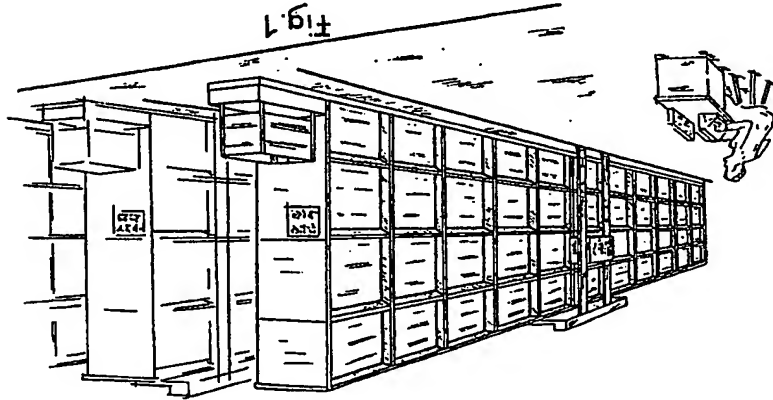


Fig. 1



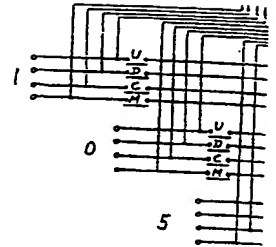


Fig. 4

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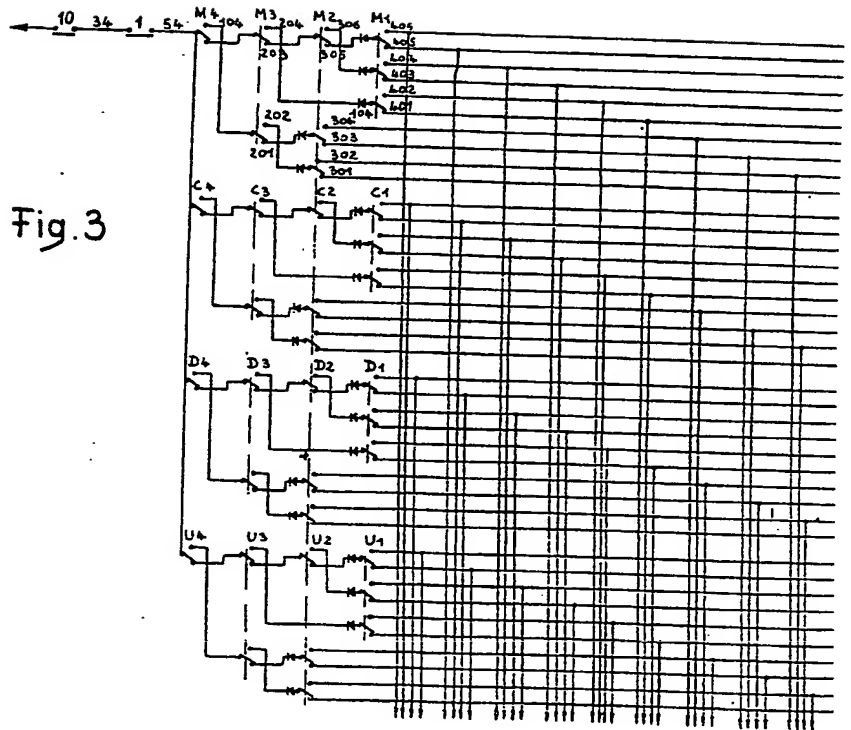
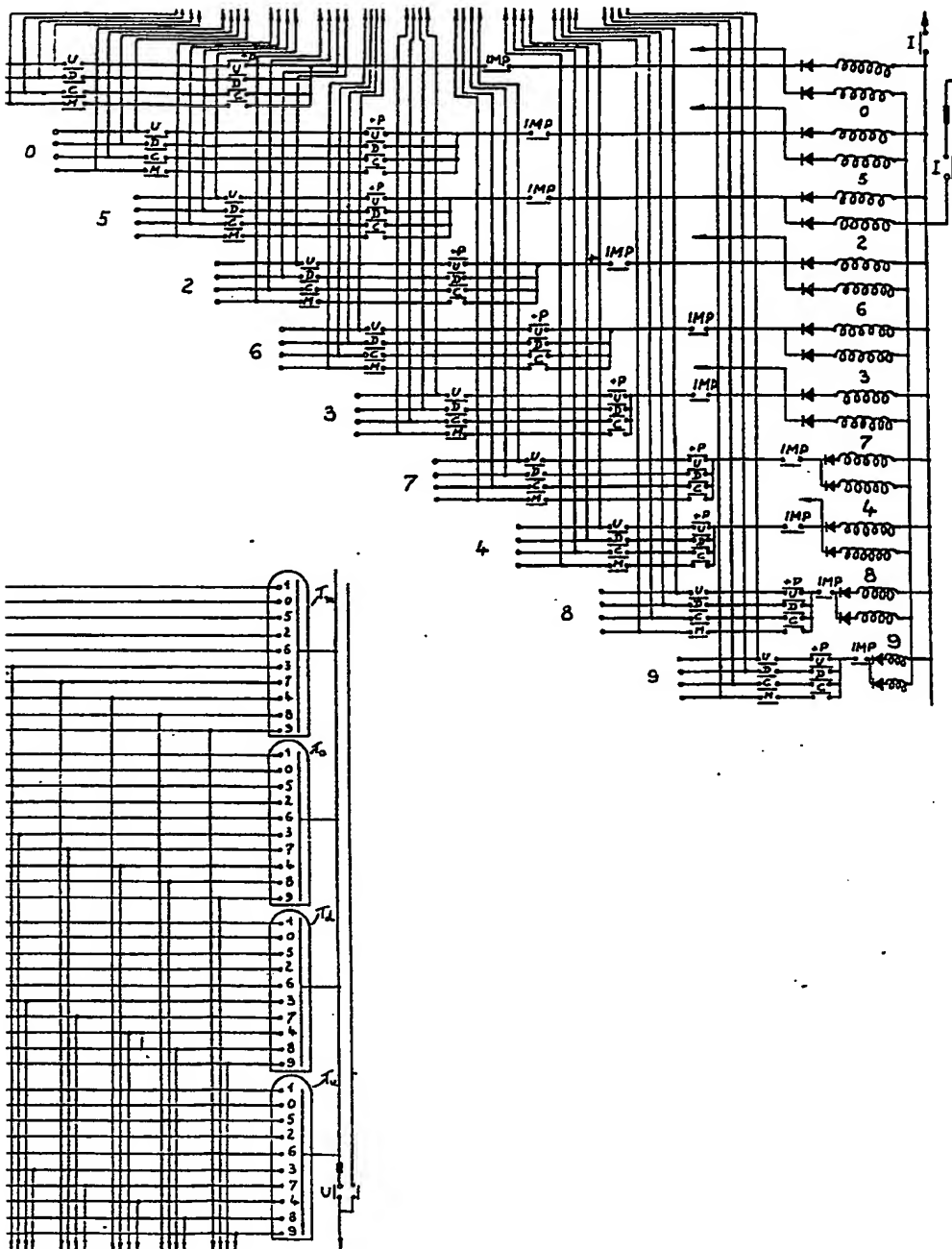


Fig. 3

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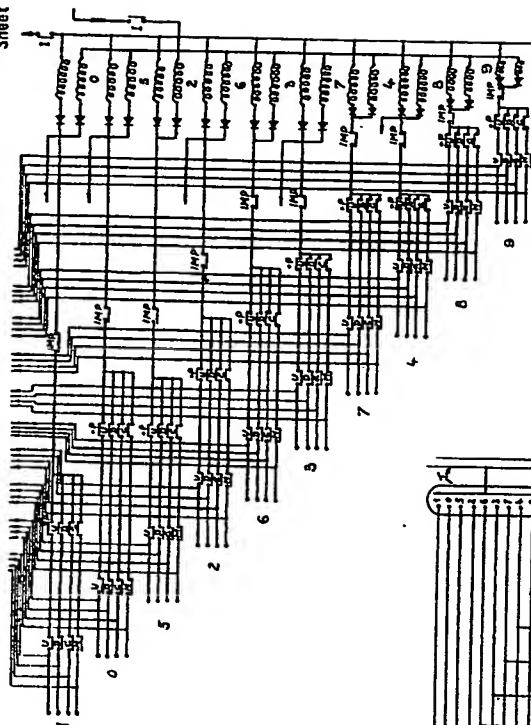


Fig. 4

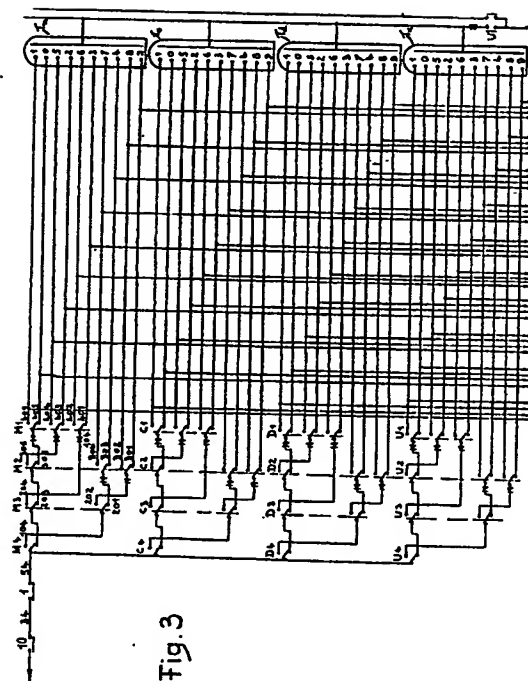
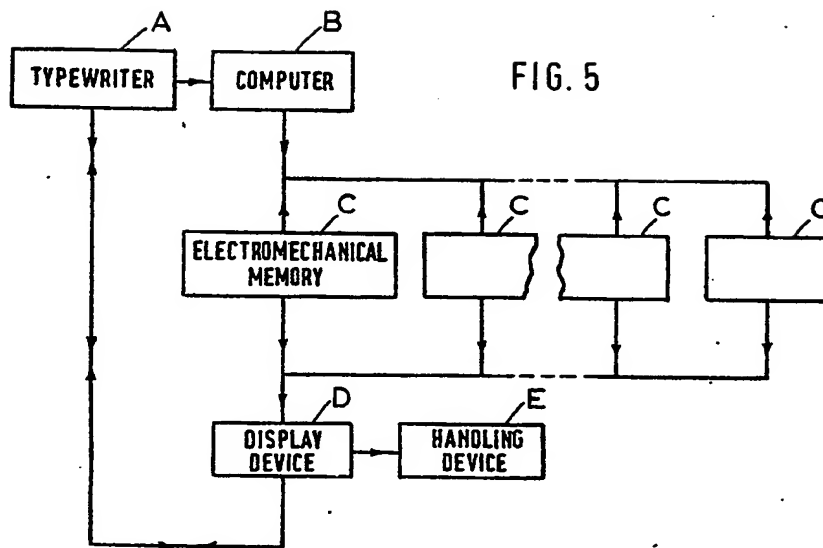


Fig. 3



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